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The use of Machine Learning techniques to analyse the h-> Zy process within the SMEFT framework at the Large Hadron Collider (LHC)

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Building on the ATLAS and CMS discovery of the Higgs boson decaying into a Z-boson and a photon (with a 3.4σ significance), the current Standard Model (SM) predictions for the $h \to Z\gamma$ signal rate exceed the measured value by 2.4 ± 0.9, indicating possible new physics effects or systematic uncertainties that warrant further investigation. This analysis investigates this rare process using machine learning techniques where we employ classifiers such as the Boosted Decision Trees (BDT), XGBoost, and the kernel density estimation to analyse the production modes of $h \to Z\gamma$ including gluon-gluon fusion (ggF), vector boson fusion (VBF), associated production with a vector boson (VH), and associated production with a top quark pair (ttH), within the framework of the Standard Model Effective Field Theory (SMEFT). This machine-learning approach aims to constrain the six-dimensional Wilson coefficients and shed light on potential deviations from SM prediction.

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